REMARKS:

This is in response to the Office Action dated December 20, 2000, which was paper #3 of the present application. Applicant cancels claims 2 and 6 without prejudice. Applicant amends claims 1, 3, 5, and 7; marked up versions of the amended claims are attached hereto pursuant to 37 C.F.R. § 1.121(c)(ii). Applicant adds new claims 9-17 to the application. Pursuant to this amendment, claims 1, 3-5, and 7-17 are pending. Reexamination and reconsideration of the application are respectfully requested.

The Examiner objects to the drawings for failing to show every feature of the invention specified in the claims. Applicant amends claims 3 and 7 to address this objection. The amended features in claims 3 and 7, respectively, are described in the application, on page 20, lines 9-16.

The Examiner objects to claims 1, 3, 5, and 7 as informal. Applicant amends claims 1, 3, 5, and 7 to address this objection.

The Examiner rejects claims 1-2 and 5-6 as anticipated by U.S. Patent No. 6,144,353 to McKnight. The Examiner rejects claims 3-4 and 7-8 as obvious over the McKnight patent in view of U.S. Patent No. 6,078,317 to Sawada. Applicant respectfully submits that all pending claims are in condition for allowance.

The present application describes a color LCD device, such as an electrically controlled birefringence (ECB) LCD, having an LCD panel 50 and a driving circuit 60 coupled to the LCD panel 50. The driving circuit 60 receives an input video signal to generate R, G, and B driving signals for driving display pixels of the LCD panel 50. FIG. 4 of the present application shows the relationship between the driving voltage and the transmittance for the R, G, and B light components in the LCD panel. As shown in FIG. 4, the peak transmittance of the R, G, and B light in the LCD panel are occurred at the driving voltages of approximately 8V, 7V, and 5V, respectively. Accordingly, to more precisely display white light in the LCD panel, voltages of the R, G, and B driving signals should be independently set at

approximately 8V, 7V, and 5V, respectively. See Application, FIG. 4, page 19, line 4-page 20, line 16.

In a preferred embodiment of the present invention, the driving circuit 60 includes a RGB driving processing circuit 70 for outputting the R, G, and B driving signals to the LCD panel 50. The RGB driving processing circuit 70 has a limit level generation circuit 84 for generating a pair of voltage level control signals (d) and (e) respectively for setting the lower limit of the OFF voltage and the upper limit of the ON voltage, resulting a waveform of each driving signal shown in (c) of FIG. 7. According to the present application, voltages of the driving signals respectively for R, G, and B displays, each with a waveform similar to the (c) of FIG. 7, can be independently set to provide the optimum transmittance of the R, G, and B light components. See Application, page 26, line 25-page 27, line 17. As a result, the presently described LCD device can achieve a more preferable color display over a conventional LCD device.

The McKnight patent, on the other hand, describes a display system for modulating a control electrode to cause an electro-optic layer to be reset to a state in which display data is not viewable. According to the McKnight patent, the display system displays the first image and then applies a first control voltage to the electrode to alter a state of the electro-optic layer such that the first image is substantially not displayed and then the display system displays a second image represented by a second plurality of pixel data values after the electrode receives a second control voltage. FIG. 2C of the McKnight patent shows time graphs respectively of a control voltage applied to the control electrode and the intensity of the pixels in the liquid crystal display. In FIG. 2C, the control voltage waveform 151 is applied to the control electrode and the intensity waveform 152 of the LCD shows pixel intensity curves 153-156 at different time periods of the time graph. These pixel intensity curves 153-156, however, are merely light intensity waveform displayed on pixels of the LCD. They do not describe anything about the driving voltages respectively for the R, G, and B display for the LCD, as described in the present application. More importantly, the McKnight patent does not describe

independently determining the upper limit values respectively of the R, G, and B signal driving voltages to achieve the largest transmittance of the R, G, and B light components displayed in the LCD device.

The Sawada patent describes a display control apparatus for display of an image by receiving an RGB video signal and vertical and horizontal synchronizing signals. According to the Sawada patent, the display control apparatus includes an interpolation processing circuit 16 to expand the image defined by the RGB image data in the vertical direction in correspondence with the display mode. Similar to the McKnight patent, the Sawada patent nevertheless does not describe the driving voltages respectively for the R, G, and B display for the LCD device. Nor does the Sawada patent describe independently determining the upper limit values respectively of the R, G, and B signal driving voltages to achieve the largest transmittance of the R, G, and B light components displayed in the LCD device.

Claim 1 of the present application recites, in pertinent part, "each of upper limit values of ranges for driving voltages respectively for R display, G display, and B display applied to the liquid crystal is set independently for R light, G light, and B light." As discussed, the McKnight patent does not describe this limitation of claim 1. Thus, claim 1 distinguishes over the McKnight patent and is in condition for allowance.

Claim 2 is cancelled.

Claims 3-4 depend from claim 1. As discussed, neither the McKnight patent nor the Sawada patent describes the above-mentioned limitation of claim 1. Thus, claims 3-4 distinguish over the McKnight patent and the Sawada patent and are in condition for allowance.

Claim 5 recites, in pertinent part, "each of upper limit values of ranges for driving voltages respectively for R display, G display, and B display applied to the liquid crystal is set independently for R light, G light, and B light." As discussed, the McKnight patent does not describe this limitation of claim 5. Thus, claim 5 distinguishes over the McKnight patent and is in condition for allowance.

Claim 6 is cancelled.

Claims 7-8 depend from claim 5. As discussed, neither the McKnight patent nor the Sawada patent describes the above-mentioned limitation of claim 5. Thus, claims 7-8 distinguish over the McKnight patent and the Sawada patent and are in condition for allowance.

Claim 9 depends from claim 1. Thus, applicant submits that claim 9 distinguishes over the art of record and is in condition for allowance.

Claim 10 recites, in pertinent part, "each of upper limit values of ranges for driving voltages for application to the liquid crystal is set independently for each of R, G, and B light, and the maximum difference among the set voltages stays within 20%." Thus, applicant submits that claim 10 distinguishes over the art of record and is in condition for allowance.

Claim 11 recites, in pertinent part, "each of upper limit values for defining the maximum light transmittance of the liquid crystal, of ranges of driving voltages applied to said liquid crystal, is set independently for each of R, G, and B light." Thus, applicant submits that claim 11 distinguishes over the art of record and is in condition for allowance.

Claim 12 depends from claim 11. Thus, applicant submits that claim 12 is similarly in condition for allowance.

Claim 13 recites, in pertinent part, "each of upper limit values of ranges for driving voltages respectively for said R, G, and B driving signals applied to said pixel electrodes is set independently for R, G, and B light." Thus, applicant submits that claim 13 distinguishes over the art of record and is in condition for allowance.

Claims 14-15 depend from claim 13. Thus, applicant submits that claims 14-15 are similarly in condition for allowance.

Claim 16 recites, in pertinent part, "each of upper limit values of ranges for driving voltages for R display, G display, and B display applied to said liquid crystal by said transparent electrode and said reflection electrode is set independently for R, G, and B light." Thus, applicant submits that claim 16 distinguishes over the art of record and is in condition for allowance.

Claim 17 depends from claim 16. Thus, applicant submits that claim 17 is similarly in condition for allowance.

The art made of record but not relied upon by the Examiner has been considered. However, it is submitted that this art neither describes nor suggests the presently claimed invention.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 337-6700 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

Date: June 14, 2001

By: _____
Wei-Fu Hsu
Registration No. 45,723
Attorney for Applicant(s)

500 South Grand Avenue, Suite 1900
Los Angeles, California 90071
Phone: 213-337-6700
Fax: 213-337-6701

Enclosure: Fig. 3 (red-lined copy)

Version with markings to show changes made:

1. (Amended) A liquid crystal display having liquid crystal sandwiched [by] between a pair of substrates having electrodes for driving the liquid crystal based on [a liquid crystal control driving signal for R light, a liquid crystal control driving signal for G light, and a liquid crystal control driving signal for B light] respective R, G, and B signals to control transmittance of each of the R [light components], G [light components], and B light components for color display, wherein

each of upper limit values of ranges for [a] driving voltages [voltage for application to the liquid crystal being set independently] respectively for R display, G display, and B display applied to the liquid crystal is set independently for R light, G light, and B light.

3. (Amended) A liquid crystal display according to claim 1, wherein

[the] a liquid crystal control driving signal for R light, [the] a liquid crystal control driving signal for G light, and [the] a liquid crystal control driving signal for B light are separately subjected to gamma correction based on transmittance characteristics of the R [light components], [the] G [light components], and [the] B light components.

5. (Amended) An electrically controlled birefringence type liquid crystal display having liquid crystal sandwiched [by] between a pair of substrates having electrodes for driving the liquid crystal based on a liquid crystal control driving signal for R light, a liquid crystal control driving signal for G light, and a liquid crystal control driving signal for B light to control transmittance of each of the R [light components], G [light components], and B light components for color display, wherein

each of upper limit values of ranges for [a] driving voltages [voltage for application to the liquid crystal being set independently] respectively for R display, G display, and B display applied to the liquid crystal is set independently for R light, G light, and B light.

7. (Amended) A liquid crystal display according to claim 5, wherein the liquid crystal control driving signal for R light, the liquid crystal control driving signal for G light, and the liquid crystal control driving signal for B light are separately subjected to gamma correction based on transmittance characteristics of the R [light components], [the] G [light components], and [the] B light components.